

## CLAIMS

1. A sensing system for sensing the proximity of a part of a user to a control input for a vehicle sub-system, the system comprising a transmitter  
5 adapted to transmit a signal, a primary receiver adapted to receive the signal via the user as a primary signal, one of the transmitter and primary receiver being adapted to be associated with the user and the other being associated with the control input, a reference receiver adapted to be associated with the user and to receive the signal via the user as a reference  
10 signal, and a controller arranged to receive the reference signal and the primary signal and to determine from them said proximity.
2. A system according to claim 1, in which the controller is arranged to determine from the reference signal the voltage of the user.
- 15 3. A system according to claim 1 or claim 2, in which the transmitter is adapted to transmit an alternating voltage signal.
4. A system according to claim 3, in which the transmitter is adapted to  
20 transmit a sinusoidal alternating signal.
5. A system according to any preceding claim in which the controller is arranged to use the primary and reference signals to determine a measure of the capacitance between the user and the primary receiver.
- 25 6. A system according to claim 5, in which the controller is arranged to use the measure of capacitance between the user and the primary receiver to determine the separation of said part of the user from the control input.
- 30 7. A system according to any preceding claim, in which the reference receiver comprises a high input impedance reference receiver for receiving the reference signal.

8. A system according to any preceding claim, in which the reference receiver comprises a detector circuit arranged to provide a measure of the magnitude and phase of the reference signal.

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9. A system according to any preceding claim, in which the primary receiver comprises a detector circuit arranged to provide a measure of the magnitude and phase of the primary signal.

10 10. A system according to claim 9 when dependent upon claim 8, in which a multiplexer is provided to arrange a single detector circuit to provide a measure of the magnitude and phase of the reference signal and the primary signal alternately.

15 11. A system according to any of claims 8 to 10, in which the detector circuit comprises a filter to filter out noise and interference not at the frequency of the transmitted signal.

20 12. A system according to any of claims 8 to 11, in which the detector circuit comprises synchronisation means arranged to obtain measurements from the primary signal or reference signal in phase with the transmitted signal and  $90^\circ$  out of phase with the transmitted signal.

25 13. A system according to any of claims 8 to 12 in which a buffer circuit is arranged to buffer the reference signal before it is input to the detection circuit.

30 14. A system according to any of claims 2 to 13, in which the reference receiver is connected alternately through different impedances and the reference signal in each case measured to obtain a measure of the voltage on the user substantially independently of capacitance, and therefore distance, between the first user and the reference receiver.

15. A system according to any of claims 9 to 14, in which a current input buffer circuit is arranged to buffer the primary signal before it is input to the detector circuit.

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16. A system according to any preceding claim, in which the control input comprises a portion arranged to be illuminated in use and the controller is arranged to vary the intensity of illumination of said portion as the separation of the user from the control input varies.

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17. A system according to claim 16, in which the intensity of illumination of the control input is adapted to increase as the separation of the user from the control input decreases.

15 18. A system according to claim 16 or claim 17, in which the control input is adapted to become illuminated once the separation of the user from the control input falls below a predetermined threshold value.

19. A system according to claim 18, in which the control input is adapted to be concealed until the separation falls below the threshold value.

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20. A system according to any preceding claim, in which the subsystem comprises a display to present information to a user and a property of the display is variable with the separation of the user from the control input.

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21. A system according to any preceding claim, in which the transmitter comprises a transmitter aerial.

22. A system according to any preceding claim, in which the primary receiver comprises a primary receiver aerial.

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23. A system according to any preceding claim, in which the reference receiver comprises a reference receiver aerial.
24. A system according to any preceding claim, in which the transmitter  
5 is in a position arranged to be associated with the user and the primary receiver is adapted to be associated with the control input.
25. A system according to claim 24, in which the transmitter is arranged to be mounted in a seat of the vehicle such that the user is a person sitting  
10 on the seat.
26. A system according to any of claims 21 to 25, in which the transmitter aerial comprises a flexible transmitter plate.
- 15 27. A system according to any preceding claim, in which the transmitter further comprises a transmitter shield associated with the transmitter to reduce coupling of the transmitter with the reference receiver or the primary receiver through a route other than via the user.
- 20 28. A system according to any of claims 24 to 27, in which the primary receiver is arranged to be mounted at or adjacent to the control input.
29. A system according to claim 28, in which the primary receiver comprises a conductive wire mounted around the control input.  
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30. A system according to any of claims 25 to 29, in which the reference receiver is arranged to be mounted in the seat of the vehicle in a position spaced from the transmitter.
- 30 31. A system according to any of claims 23 to 30, in which the reference receiver aerial comprises a flexible plate.

32. A system according to any preceding claim, in which the reference receiver further comprises a reference shield associated with the reference receiver to prevent coupling between the transmitter and the reference receiver by any route other than via the user.

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33. A system according to any preceding claim, in which the control input is a hand operated input member.

34. A system according to any of Claims 30 to 33, in which the control  
10 input includes a screen comprising a conductive layer which forms the primary receiver.

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35. A system according to any preceding claim, in which the reference shield and the transmitter shield are electrically grounded.

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36. A system according to any preceding claim for sensing the proximity of a part of any of a plurality of users to the control input comprising a transmitter or primary receiver associated with each user and a reference receiver associated with each user.

37. A system according to claim 36, in which the controller is arranged to alternately calculate the proximity of each user from the control input.

38. A system according to claim 36 when dependent on any of claims 10  
25 to 35 or claim 37, in which the multiplexer is provided to arrange the single detector circuit to provide a measure of the magnitude and phase of the reference signal and the primary signal alternately from each user.

39. A system substantially as hereinbefore described with reference to  
30 the accompanying drawings.